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Technical Memorandum 24-80

AUTOMATION OF TASK ANALYSIS DATA: THE LOGISTIC SUPPORT ANALYSIS RECORD/HUMAN FACTORS ENGINEERING ENHANCEMENT PROPOSAL

Dennis I. Serig

November 1980
AMCMS Code 612716.H700011

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U. S. ARMY HUMAN ENGINEERING LABORATORY
Aberdeen Proving Ground, Maryland

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Several disciplines use task analysis during system development. Although the form of the analysis differs from discipline to discipline, the basic data needs overlap. Development of the LSAR/HFE enhancement proposal was an ambitious effort to modify an existing task analysis data base in a way which would take advantage of this overlap. Satisfaction of the human factors engineer's data needs was given particular attention, but other potential users were expected to benefit as well. Negative effects on the logistician's use of the LSAR were not expected.

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AUTOMATION OF TASK ANALYSIS DATA: THE LOGISTIC SUPPORT ANALYSIS RECORD/HUMAN FACTORS ENGINEERING ENHANCEMENT PROPOSAL

INTRODUCTION

Task analysis has been defined as "...the systematic study of the behavioral requirements of tasks..." (Miller, 1963). As such, it is a tool frequently used during system development. Among the more important uses of task analysis are those associated with the human factors engineering of the system being developed (DeGreene, 1970).

Human Factors Engineering and Task Analysis

Task analysis provides one means by which the human factors engineer can assist in both the design and evaluation of a system. During system design, task analysis is used to determine the hardware and software characteristics necessary for adequate human performance. It is used similarly to determine necessary tools and aids. During system evaluation, task analysis is used to determine whether the human performance requirements of the system exceed human performance capabilities. Guidance in the use of task analysis for these purposes has been provided by Berson and Crooks (1976) and by Swain (1976). Extensions of task analysis, which permit evaluation of such things as workload, task allocation and the effect of errors have been described by Bryan and Regan in Van Cott and Kinkade (1972).

Through task analysis, the human factors engineer determines the psychological and physiological demands placed on personnel by the system, and then translates these demands into human factors engineering requirements. During design, the goal is to develop an adequate interface between personnel and the system hardware and software. During evaluation, the goal is to assess the effect of this interface on the ability of personnel to perform assigned tasks. In either case, the operations associated with task analysis require a supporting data base. Without adequate data base support, no task analysis would be possible (DeGreene, 1970).

The Task Analysis Data Base

Task analyses draw upon a number of types of data. The most essential type is that which describes the acceptable (planned) personnel interactions with system hardware and software. These task description

data provide both the structure into which other essential data fit and the starting point for any task analysis (DeGreene, 1970). For the human factors engineer, other essential data describe personnel selected to perform various tasks, their training, and their equipment. Human performance time and error data, data on test conditions and data on performance standards are also essential to the human factors engineer's task analysis.

The data base needed to support task analysis should develop with the system to which it relates. In the early (planning and design) phases of system development, rudimentary task description data may be all that is available, but as the system matures the task description portion of the data base is expanded and refined. Other essential data become available as well. During the early phases of system development, the growing data base supports task analyses which help determine those interface characteristics which will increase the likelihood of adequate human performance and system success. Repeated task analysis, as the data base continues to grow, allows the human factors engineer to address more of the personnel interface with system hardware and software.

By the evaluation phase, the task analysis data base should include human performance time and error data and data describing test conditions. The human factors engineer uses these data, in conjunction with those developed earlier, to answer the question; "Can system personnel, given the specified equipment and training, perform the tasks required of them, and, if so, to what standard?" Depending upon the answer to this question, system modification along with appropriate updates of the task analysis data base may follow. In most systems, design and evaluation follow one another cyclically, with task analysis being used alternately to improve and evaluate the system.

Obstacles to Task Analysis

The idealized pattern of growth and use of the task analysis data base described above is not typical. Competition for resources during system development often means assignment of a low priority to development of the task analysis data base. Occasionally, no organized data base capable of supporting a task analysis is available to the human factors engineer. Even when task analysis data bases are available, their availability often lags the need, their level of completeness seldom satisfies the full scope of their potential use, and their organization makes use difficult. As a result, use of task analysis by the human factors engineer during system design and evaluation is frequently impossible.

Without timely use of task analysis by the human factors engineer, many problems can lie hidden until the late phases of system development. Because the cost-benefit relationship for changes to a system favors early changes over late changes, the impact of delayed discovery of these problems can be tremendous.

The impact of failing to discover these problems can, of course, be worse. If system development is to be affordable, and if adequate interfaces are to be established between personnel and the system's hardware and software, data to support the human factors engineer's task analysis are essential.

OVERCOMING THE OBSTACLES TO TASK ANALYSIS

Problems with the availability, completeness, and organization of task analysis data bases are not insurmountable. An increasingly viable means for resolving these problems is an automated task analysis data base developed side-by-side with the system to which it is related. Development of this data base can be iterative with level of detail increasing as system hardware and software matures. Iterative development can also accommodate inclusion of personnel and training data and the progression from estimated to measured human performance data.

The human factors engineer is not the only user of task analysis. For example, training developers and logisticians use task analysis during system design and evaluation. These and other users of task analysis have no less a need for a task analysis data base than the human factors engineer. And, although the products of others' task analyses differ from the products of a human factors engineer's task analysis, the basic data needs are similar. In each case task description data provide the structure into which other data fit. This suggests that a suitably designed task analysis data base could satisfy both the human factors engineer and other users of task analysis. Considering the competition for resources during system development, the possibility that a single data base might overcome the obstacles to task analysis for a number of important users would seem appealing.

Automated Task Analysis Data Base

The notion of an automated task analysis data base is not new. DeGreene (1970) cites several efforts by human factors engineers to develop such a data base. Although the outcome of these efforts is unknown, they do not appear to have resulted in the development of widely used products. Another example, the basic structure of which is provided by task description data, is the Logistic Support Analysis Record (LSAR).

The LSAR is a contract data item delivered during military system development. Its purpose is to assist the logistician in determining the system's elements of support (e.g. maintenance plan, support and test equipment, etc.). Development and continual improvement of the LSAR are, in fact, the logistician's attempt to overcome the obstacles to task analysis. Success will ensure the availability of a sufficiently complete and well organized task analysis data base to satisfy the logistician's need.

Forging an LSAR/HFE Link

Because its traditional products have little direct bearing on their role in system development, human factors engineers seldom use the LSAR. This situation may change, however, due to recent recognition of the LSAR's potential for satisfying the data needs of a number of users. The Army is now making formal efforts to incorporate the data needs of a number of potential users into the LSAR and to provide these users with automated output reports. These efforts are of particular interest to the human factors engineer because of the LSAR's recognized potential for overcoming the obstacles to task analysis. Development of a proposal for Human Factors Engineering (HFE) enhancement of the LSAR by the Army's Human Engineering Laboratory is one response to this recognition.

THE LSAR/HFE ENHANCEMENT PROPOSAL

The goal of the LSAR/HFE enhancement proposal was to modify the LSAR to take advantage of the overlapping task analysis data needs of the logistician and human factors engineer. The proposal was based on a review of documents describing the LSAR and HFE task analysis data needs. Documents of particular interest were:

DARCOM-P 750-16	Darcom Guide to Logistic Support Analysis
MIL-H-46855B	Human Engineering Requirements for Military Systems, Equipment and Facilities
DI-H-7055	Critical Task Analysis Report
DI-H-7056	Human Engineering Design Approach Document - Operator
DI-H-7057	Human Engineering Design Approach Document - Maintainer
DI-H-7058	Human Engineering Test Report

This review suggested both input and output of task analysis data needed to be improved to enable the LSAR to satisfy the human factors engineer's need for task analysis data. Both areas were addressed by the LSAR/HFE enhancement proposal.

Input Modifications

A number of LSAR data element definitions were found to express needs overlapping those of the human factors engineer. The overlap included clusters of data in the areas of task description, task related information and test results. Although existing input in these areas was not sufficient to satisfy the human factors engineer's need for task analysis data, it was felt that it provided a good base upon which to build. Modification of existing data elements and addition of new data elements were proposed to overcome shortcomings. The input changes needed in each of the three areas of overlap are discussed below. Appendixes A and B contain rationales and definitions for proposed modifications and additions.

Task Description Data. As noted previously, task description data is essential to task analysis. To be useful to the human factors engineer, these data must be human behavior oriented, consistently and logically organized, and sufficiently detailed. The "Sequential Task Description," as defined in the LSAR, did not appear to ensure that these criteria would be met. As an improvement, redefinition of Sequential Task Description to accommodate the notion of "task hierarchy" was suggested. The new definition was designed to impose a human behavioral orientation, consistent organization, and specified level of detail on LSAR task description data; thereby allowing its use by the human factors engineer.

The task hierarchy proposed for inclusion in the LSAR was one developed by the Test and Evaluation Subgroup of the Tri-Service Human Factors Engineering Technical Advisory Group. This selection was based on human factors engineer and trainer support for the hierarchy and, evidence that it was not only compatible with the logistician's use of the LSAR, but would enable others to use task analysis data in the LSAR as well.

Task Related Data. The human factors engineer uses task analysis to determine whether personnel, given the specified training and equipment, can perform their assigned tasks, and, if so, to what standard. In order to answer these questions, data relating to the personnel, their training, and their equipment must be available along with the task description data. Existing LSAR input was found to include some, but not all, of the required task related data. Incorporation of the missing data through modification and addition of data elements was suggested. The proposed modified and new data elements were as follows:

MODIFIED:

Number of Men Per Task

Task Criticality

NEW:

Critical Task Information

Personnel Position

Performance Standard Description

Sequence Line Number of Simultaneous Unit of Work

Task Number

Tools, Equipment, and Aids

Work Category Code

The human factors engineer's need for task related data is greater for critical tasks than for other tasks. LSAR input did not satisfy these needs. Modifying the definition of "Task Criticality" in a way which would ensure proper identification of critical tasks, and adding "Critical Task Information" was suggested. The latter data element consisted of a number of subelements and was designed to provide the critical task data specified by MIL-H-46855B and DI-H-7055.

Test Report Data. The question of whether personnel, given the specified training and equipment, can perform assigned tasks should finally be addressed by human performance time and error data. When human performance data are available, other data which will permit assessing its validity and generalizability are also needed. Existing LSAR data elements satisfied neither of these requirements.

With respect to measured human performance, the LSAR allowed recording of mean elapsed times. It did not, however, specify whether the mean was based on times for all performances, or on some subset of performances (e. g. error-free performances, error-free and error-corrected performances). In terms of the validity of the human factors engineer's assessment, it was felt that the most valuable definition for mean elapsed time would specify that it be based only on error-free and error-corrected performances. No data on the variability of human performance time or on human performance errors was found to be available in the LSAR. The proposed improvement involved modifying an existing LSAR data element and adding three new data elements. These were as follows:

MODIFIED:

Elapsed Time (Mean)

NEW:

Error Description

Error Rate

Standard Deviation

None of the data required for assessing the validity and generalizability of human performance data were found to be available in the existing LSAR. The proposed improvement involved adding several new data elements. These were as follows:

NEW:

Data Collection Techniques

Human Performance Problems and Hazards

Number of Test Participants

Test Background

Test Methods and Controls

Output Modifications

If the LSAR is to serve the human factors engineer's task analysis data needs, there must be a simple means for accessing the data. Because task analysis data lends itself to automation, a specific LSAR/HFE output form was proposed as the primary means of access. An example form is provided in Appendix C. Output of task description data was a major feature of the example form. Much task related and test data, keyed to the task description, were provided for as well.

Due to their narrative form, some of the human factors engineer's task analysis data needs were felt to have low compatibility with output forms like the example. Thus, the example form did not provide for output of:

Critical Task Information

Error Description

Human Performance Problems and Hazards

Test Background

Test Methods and Controls

The example output form did, however, provide "flag" items which could be used to determine when the omitted data were available.

The possibility of separate LSAR input forms for the strictly narrative data needed for the human factors engineer's task analysis was raised. These input forms could be maintained in any of a number of ways (e.g. hardcopy, microfiche, word processor) and their existence would be

indicated on the LSAR/HFE output form by flag items (e.g. task criticality, error rate). The data could be accessed, when needed, through use of the new Task Number data element.

A "SELECT" option which allowed tailoring of output reports along specified parameters was an integral feature of the LSAR. A great deal of flexibility and economy in accessing the LSAR's task analysis data could be realized through use of this option. Incorporating the following SELECT options into the procedures for accessing the proposed LSAR/HFE output form was suggested:

Work Category

Maintenance Level

Personnel Position

Skill Specialty Evaluation

Task Criticality

Error Rate

SUMMARY AND DISCUSSION

Several disciplines use task analysis during system development. Although the form of the analysis differs from discipline to discipline, the basic data needs overlap. Development of the LSAR/HFE enhancement proposal was an ambitious effort to modify an existing task analysis data base in a way which would take advantage of this overlap. Satisfying the human factors engineer's data needs was given particular attention, but other potential users were expected to benefit as well. Negative effects on the logistician's use of the LSAR were not expected.

Implementing the LSAR/HFE proposal may, of course, face real world limitations. For instance, task description data are not currently automated in the LSAR. Automation of summary data, compiled from the task description data, has been sufficient to support the logistician's use of task analysis. Thus, despite plans for automating the task description data, there may be some reluctance to do so. Such reluctance may postpone or prevent benefits from the LSAR/HFE enhancement proposal. Hopefully, full recognition of the value of enhancing the LSAR will prevent such a situation from arising. As another example, the inclusion of some of the data asked for in the proposal may exceed the scope of an LSAR which is wholly prepared by a system contractor. Thus, data crucial to the human factors engineer's task analysis (e.g. test report data) may be beyond LSAR input capabilities. If this should be the case, developing means for linking task analysis data in the LSAR to that in other data bases may be necessary.

Despite possible limitations, even partial implementation of the basic input and output ideas developed in the LSAR/HFE enhancement proposal offers the possibility of increasing the availability of task analysis data for all potential users while reducing duplication of effort. Continued interface among current and potential users of the LSAR is needed, and should result in increasingly sophisticated and useful ways of handling task analysis data. The increased frequency with which task analysis can actually be performed should result in economical development of better systems.

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APPENDIX A

NEW AND MODIFIED DATA ELEMENTS

New and Modified Data Elements

Data Element Number	Data Element Title	Included on Proposed LSAR/HFE Computer Output Form	Reason for Addition or Modification
(N) 023.1	Critical Task Information	No	To provide necessary details about critical tasks.
(N) 024.1	Data Collection Techniques	No	Used for determination of the validity and generalizability of human performance measurements.
032	Elapsed Time (Mean)	Yes	To accommodate the task hierarchy and specify that times be on error-free performance.
(N) 034.1	Error Description	No	To aid in determination of personnel-equipment interface adequacy.
(N) 034.2	Error Rate	Yes	Computer output flag to error descriptions, and to indicate the extent of possibile HFE problems.
(N) 055.1	Human Performance Problems and Hazards	No	To aid in determination of personnel-equipment interface adequacy.

Proposed new Data Elements are indicated by (N) preceding the Data Element Number.

(Continued)

New and Modified Data Elements

Data Element Number	Data Element Title	Included on Proposed LSAR/HFE Computer Output Form	Reason for Addition or Modification
107	Number of Men per Task	Yes	To provide total number, regardless of skill specialty.
(N) 119.2	Performance Standard Description	Yes	To supply applicable standards as a basis for assessing human performance.
(N) 120.1	Personnel Position	Yes	To aid in workload assessment, and to serve as a SELECT option.
(N) 162.1	Sequence Line Number (SLN) of Simultaneous Unit of Work	Yes	To clarify the full extent of work activities taking place at any one time.
163	Sequential Task Description	Yes	To ensure a human behavioral orientation and to incorporate the task hierarchy.
(N) 176.1	Standard Deviation	Yes	To aid in determination of the validity and generalizability of human performance times.
182.2	Task Criticality	Yes	To ensure proper indentification of critical tasks.
(N) 183.1	Task Hierarchy	Yes	To ensure consistent and logical organization of task description.

(Continued)

New and Modified Data Elements

Data Element Number	Data Element Title	Included on Proposed LSAR/HFE Computer Output Form	Reason for Addition or Modification
(N) 185.1	Task Number	Yes	To assist in cataloguing task related information.
(N) 188.1	Test Participants	Yes	To aid in determination of the validity and generalizability of data.
(N) 193.1	Test Background	No	To aid in determination of the validity and generalizability of data.
(N) 193.2	Test Methods and Controls	No	To aid in determination of the validity and generalizability of data.
(N) 196.1	Tools, Equipment, and Aids	Yes	To clarify the equipment etc. to be used in a task.
(N) 224.1	Work Category Code	Yes	To allow for recording both operational and maintenance tasks.

APPENDIX B

PROPOSED DATA ELEMENT DEFINITIONS

(Proposed modifications to existing Data Elements are underlined.)

(N) 023.1 Critical Task Information

A series of narrative elements used in determining whether human engineering technical risks have been minimized in the design of the equipment/system; recorded only for critical tasks (DED 182.2) due to the likelihood that poor human performance on a critical task would have extremely undesirable effects.

a. Task Information Required - Information needed by the operator/maintainer for performance of the task, including cues for task initiation.

b. Task Information Available - Information provided by whatever means to the operator/maintainer by the equipment/system and necessary for task performance.

c. Evaluation Process - The mental processing required by the operator/maintainer in order to make a decision based on information provided by the equipment/system.

d. Decision(s) - The alternative states of the equipment/system or environment discernable through evaluation of input information.

e. Action(s) - Activities based on a decision or decision(s) and designed to affect the state of the equipment/system.

f. Feedback - Information provided by whatever means to the operator/maintainer relative to the effect of action(s).

g. Timing and Frequency - How often the described action is expected to be required and any associated time constraints.

h. Tolerances - The standard to which the action must be performed.

i. Body Movements - Movements of the body required to complete an action including body part involved, speed, direction and extent of movement, starting point, force required and whether or not movement must be visually guided.

j. Workspace Envelope, Required - A description of the space required to perform the body movements needed to complete an action.

k. Workspace Envelope, Available - A description of the space available for body movements in the completion of an action.

l. Location and Condition of the Work Environment - A description of the location at which an action will be taken,

(N) 023.1 Critical Task Information (Cont.)

and of the environmental conditions at that location (e.g. lighting, temperature, humidity, ventilation, vibration).

m. Personnel Interaction - A description of the communication and other personnel interactions required for performance of units of work involving more than one person (function allocation level and higher).

n. Personnel Limitations - A description of any human limitations bearing on the reception of required information, the required evaluation and decision making processes, or response actions.

o. Equipment/System Limitations - A description of any limits of the machine or software affecting the ability of personnel to perform in the required manner.

(N) 024.1 Data Collection Techniques

A narrative description of data collection techniques used in obtaining measured human performance data. It will include:

a. Identification of the quantitative and qualitative measures of both human and system performance.

b. Description of methods, procedures and instrumentation used in data collection.

c. Description of techniques used for data reduction, statistical techniques employed, and confidence levels selected.

032 Elapsed Time, Mean

Time expended to complete a unit of work. The elapsed time for any unit of work will reflect accurately the elapsed times of its subordinate units of work. Where subordinate units are performed sequentially the elapsed time for a unit of work should equal the sum of the elapsed times for its subordinate units of work. Where there is some degree of simultaneity of performance of subordinate units of work, elapsed time of the unit of work in question will be less than the sum of the elapsed times for the subordinate work units by an amount consistent with the degree of overlap. Elapsed times will not include logistic delay times. The elapsed time associated with any unit of work may be categorized as follows:

a. Allocated - The maximum time allowed for error-free completion of the unit of work.

032 Elapsed Time, Mean (Cont.)

b. Predicted - The estimated time required for error-free completion of the unit of work.

c. Measured - (1) The mean observed time for error-free completion of the task (EFT). (2) The mean observed time spent in correcting human performance errors (ECT).

(N) 034.1 Error Description

A narrative data element providing descriptions of human performance errors. The following subelements will be included:

a. Narrative description, with photograph(s) if appropriate, of each error. Include frequency of occurrence of each error during test.

b. Consequence (brief statement of the immediate effects of the error on system operation).

c. Causes (isolation of the immediate cause of each actual performance error and identification of the events, conditions, operator workload, environmental factors and equipment configurations which may have contributed to it).

d. Explanation by participants making errors of the reasons for the errors.

e. Recommended solutions stated in terms of equipment redesign, alteration of tasks, personnel selection and/or training (if available).

(N) 034.2 Error Rate

Number of human performance errors divided by number of repetitions of each task element.

(N) 055.1 Human Performance Problems and Hazards

A narrative element describing personnel-equipment incompatibilities and hazards observed during tests. It will include:

a. Human Performance Problems

1. Description of any human performance adversely affected by equipment configurations or characteristics.

2. Recommended solutions in terms of equipment design, task design, personnel selection or training (if available).

(N) 055.1 Human Performance Problems and Hazards (Cont.)

b. Hazards

1. Narrative description of observed hazards, their frequency, severity and consequence.

2. Recommended action to minimize or eliminate the hazard in terms of equipment design, task design, personnel selection or training (if available).

107 Number of Men per Task

Total - The total number of men required for performance of the unit of work, whether full or part time. Entries will be made for function allocation and higher levels of work.

Per SSC - The total number of soldiers required with a particular SSC, whether full or part time, to perform a given unit of work.

(N) 119.2 Performance Standard Description

A narrative description of any performance standard for time or precision keyed to SLN in the sequential task description for a unit of work.

(N) 120.1 Personnel Position

Identifies the personnel position of the individual responsible for completion of a unit of work (e.g. Driver, Gunner, etc.). Limited to crew level work activities.

(N) 162.1 Sequence Line Number (SLN) of Simultaneous Unit of Work

An indicator used to designate which units of work overlap or are performed simultaneously. This consists of a notation of the sequence line number of the overlapping or simultaneous units of work.

163 Sequential Task Description

A narrative description of the complete effort expended to accomplish a specific maintenance or operator unit or work.

163 Sequential Task Description (Cont.)

The description will show the sequential and simultaneous manual and cognitive activities of personnel operating, maintaining or controlling the system or equipment. Descriptions will be consistent with the Task Hierarchy (DED 183.1). Sequential descriptions for units of work requiring the activites of more than one person for completion will include any communications requirements. Description will include details as to removal of connectors or attachments, checkout, fault isolation, and safety precautions. Details should include procedures, tolerances, qualifying notes, special training required, etc. All requirements for power, compressed air, and environmental considerations will be specified.

(N) 176.1 Standard Deviation

The statistical measure indicating the spread of measured human performance times. Reported only when human performance time for more than one test participant has been measured for the unit of work in question.

182.2 Task Criticality

A binary code keyed to task level entries in sequential descriptions (DED 163) and used to indicate whether or not the task is critical. A task is critical if failure to accomplish it in accordance with system requirements would result in adverse effects on system reliability, efficiency, effectiveness, safety or cost. A task will also be designated as critical whenever system design characteristics approach human limitations and thereby significantly increase the likelihood of degraded, delayed or otherwise impaired mission performance.

(N) 183.1 Task Hierarchy

A framework which assures a logically consistent and mutually exclusive work-level classification scheme. Any unit of work can be properly classified at one, and only one, level of the task hierarchy. A unit of work may have subordinate units of work, classified at lower levels on the task hierarchy; and may itself be subordinate to units of work classified at higher levels on the task hierarchy. Task hierarchy levels are as follows:

(N) 183.1 Task Hierarchy (Cont.)

WORK LEVEL	WORK LEVEL DESCRIPTION

1. MISSION - What the man-machine system is supposed to accomplish.

2. SCENARIO/CONDITIONS - Categories of particular factors or constraints under which the system will be expected to operate and be maintained.

3. FUNCTION - A broad category of activity performed by a man-machine system.

4. JOB - The combination of all human performance requirements (duties and tasks) of one personnel position in a system.

5. DUTY - A set of operationally-related tasks within a given job.

6. TASK - A composite of related activities (perceptions, decisions and responses) performed for an immediate purpose, written in operator/maintainer language.

7. SUBTASK - Activities (perceptions, decisions and responses) which fulfill a portion of the immediate purpose within a task.

8. TASK ELEMENT - The smallest logically and reasonably definable unit of behavior required in completing a task or subtask.

NOTES:

1. Levels 1 and 2 are intended to be stated by the government.

2. Levels 4 and 6 must always be stated; the other levels are optional unless the government requires them to be stated.

(N) 185.1 Task Number

A number which uniquely identifies task level units of work. Used as a means for retrieving catalogued data (one possibility is the combination of the current task code with its LSAR control number).

(N) 188.1 Test Participants

The number of personnel for whom measured human performance time is available (and used in computing mean elapsed time) for the unit of work in question.

(N) 193.1 Test Background

a. Test Title - Name of the test during which measured human-performance data was obtained for the unit of work being described (e.g. Physical Teardown/Maintenance Evaluation).

b. Test Purpose and Objectives - A narrative description of the equipment/system being tested and a statement of the purpose of the test. Specific objectives, stated in terms of hypotheses to be tested, will be described if appropriate.

c. Test Date - The date (or start and finish dates) on which the test was run.

d. Test Location - A narrative description of the test location including environmental conditions and facilities available.

e. Testers - Names and organizational affiliations and addresses of individuals supervising the test.

(N) 193.2 Test Methods and Controls

a. Standards - A narrative statement of any human performance (time and error) standards contained in the equipment/system development documents. This will include assumed contribution to error. If none, so state.

b. Test Environment - A narrative description of environmental conditions at each distinct location of human activity.

Description will include noise and illumination levels, shock and vibration, air temperature, humidity and ventilation. It will also include concentration of and duration of test participant exposure to toxic and hazardous substances along with a statement as to whether that exposure was within applicable safety limits.

c. Test Participants - A series of numerical, coded, and narrative data elements completed for each test participant.

Numerical and Coded:

- Age
- Height
- Weight
- Physical Profile (PULHES)
- Civilian Education (1-16, Bachelor's Degree, Graduate Degree)
- Military - Civilian
- Length of Service with Present Employer
- Months of Experience in Tested Personnel Position
- End-of-Training Score

Narrative:

- Occupation or MOS
- Special Education Related to Test Participation (Course Title)

d. Clothing and Equipment - A narrative description of individual clothing and equipment worn, carried or otherwise borne by test participants. This will include items such as weapons, communications equipment headgear, handwear, and other protective equipment (e.g. CBR, arctic survival).

e. Test Participant Training - A narrative description of the type and amount (hours) of system specific pretest training given test participants. Various types of training will be differentiated (e.g. class- room, hands-on). Type and content of training assessments will be recorded along with the time intervals between end-of-training, training assessment, and start of the test.

f. Equipment Description - A narrative description of the equipment, simulator or mockup being used for the test.

(N) 193.2 Test Methods and Controls (Cont.)

g. Test Deviation(s) - A narrative description of test conditions which differ from conditions of expected use for the equipment/system. This will include the reason(s) for the deviation(s) and a statement as to expected impact on the validity and generalizability of the test data.

(N) 196.1 Tools, Equipment, and Aids

A data element used to specify the materials necessary for completion of a task element. Aids are defined as materials incorporating work related information and used to assist performance (e.g. manuals, checklists, wiring diagrams, nomographs).

(N) 224.1 Work Category Code

Operational = O

Maintenance = M

APPENDIX C

EXAMPLE LSAR/HFE OUTPUT FORM

EXAMPLE LSAR/HFE COMPUTER OUTPUT FORM

END ITEM ACRONYM CODE - M151A
SYSTEM - XXX
SUBSYSTEM - XXX
COMPONENT - XXX
WORK AREA - XXX
DRAWING NUMBER (S) - XXX

TASK IDENTIFICATION - REMOVE AND REPLACE ENGINE
TASK CRITICALITY - XXX
WORK CATEGORY CODE - XXX
MAINTENANCE (LEVEL) CODE - ORGANIZATIONAL

MAN ID	PERSONNEL POSITION	SKILL SPECIALTY CODE REQUIRED	SKILL LEVEL REQUIRED	SKILL SPECIALTY EVALUATION
X	XXX	XXX	XXX	XXX
X	XXX	XXX	XXX	XXX

MAN ID	SEQUENCE LINE NUMBER (SLN)	SEQUENTIAL TASK DESCRIPTION (NARRATIVE)	TASK HIERARCHY LEVEL	TASK NUMBER	SLN SIMULTANEOUS UNIT OF WORK	TOOLS EQUIPMENT AND AIDS	PERFORMANCE STANDARDS	ELAPSED TIME ALLOCATED	ELAPSED TIME ESTIMATED	MEASURED EFT	MEASURED ECT	STANDARD DEVIATION	TEST PARTICIPANTS	ERROR RATE
	1	REMOVE AND REPLACE ENGINE	FA					XXX	XXX	XXX	XXX	XXX	10	XX
X	2	TASK A	T	XXX	7			XXX	XXX	XXX	XXX	XXX	5	XX
	3	SUBTASK A1	ST						XXX	XXX	XXX	XXX		XX
	4	TASK ELEMENT A1a	TE			XXX	XXX			XXX	XXX	XXX		XX
	5	TASK ELEMENT A1b	TE			XXX				XXX	XXX	XXX		XX
	6	SUBTASK A2	ST			XXX			XXX	XXX	XXX	XXX		XX
	14	TASK E	T	XXX		XXX		XXX	XXX	XXX	XXX	XXX		XX
	15	TASK F	T	XXX				XXX	XXX	XXX	XXX	XXX		XX
	16	SUBTASK F1	ST			XXX			XXX	XXX	XXX	XXX		XX
	17	SUBTASK F2	ST			XXX			XXX	XXX	XXX	XXX		XX
Y	7	TASK B	T	XXX	2			XXX	XXX	XXX	XXX	XXX	5	XX
	8	SUBTASK B1	ST			XXX			XXX	XXX	XXX	XXX		XX
	9	SUBTASK B2	ST						XXX	XXX	XXX	XXX		XX
	10	TASK ELEMENT B2a	TE			XXX				XXX	XXX	XXX		XX
	11	TASK ELEMENT B2b	TE			XXX	XXX			XXX	XXX	XXX		XX
	12	TASK C	T	XXX		XXX		XXX	XXX	XXX	XXX	XXX		XX
	13	TASK D	T	XXX		XXX		XXX	XXX	XXX	XXX	XXX		XX

SLN	PERFORMANCE STANDARDS DESCRIPTION
4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
11	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX